inversion for the Vapor, Liquid and Frozen Phases of the Water Molecule over Mount Rainier, WA from Solar Reflected Spectra Measured by the. Airborne Visible/lnfl ared imaging Spectrometer (AVIRIS)

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Wc analyzed the calibrate.d data collected on 19 Jul y 1994 by the Airborne Visible/infrared imaging Spectrometer (AVIRIS) over an 11 by 20 km region centered on Mount Rainier, WA. AVIRIS measures upwell ing spectral radi ance from 400 to 2500 nm sampled cent iguousl y at 1() nm intervals. Spectra arc collected as images with 11 km width and up to 100 km length with 20 by 20 meter spatial sampling. These data sampled a range of snow and icc conditions from the base to the summit of the volcano.

From the AVIRIS radiance spectra, wc solve for the equivalent path transmittance of the vapor, liquid and frozen phases of water. The inversion algorithm operates on the absorption centered at 940, 980 and 1030 nm for these three phases using the MODTRAN3 atmospheric radiative transfer code linked to a model of the liquid and frozen water optical properties.

We derive the abundance of these three phases of water is derived in units of equivalent path transmittance. Over this 11 by 20 kilometer data set: water vapor ranges from 0.5 to 20.0 precipitable mm, liquid water vapor ranges from () to 5.0 mm, and frozen water ranges from O to 22.() mm. At the summit of Mount Rainier no liquid water in measured in the spectrum, indicating the snow and ice have not commenced melting. Down slope from the summit a transition zone shows both liquid and frozen water in the spectrum, Based on this phase transition, the temperature of the snow is 00 C in this region. Further down slope the amount of liquid water in the snow and ice of Mount Rainier increases consistent with increased melting at lower elevations. Frozen water in the spectrum is absent in the rock and vegetated areas of the lowest elevations. However, at the lowest elevation, liquid water is mapped in the leaves of the vegetation. These results demonstrate a ncw approach to simultaneously measure the three phases of water in snow and ice covered regions.